

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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TITLE: MECHANICAL ACTUATOR INCLUDING A HELICAL-CAM NUT

Preliminary Amendment: CLAIM AMENDMENTS

1. (Currently amended) Actuator ~~including~~ comprising:

a first tubular body ~~(20)~~,

a nut ~~(70)~~ positioned inside the tubular body ~~(20)~~ and having at least a generally helical ball-race ~~(41-51; 52-62)~~ including with a helical portion extending about the nut ~~(70)~~ according to an angle of less than 360 degrees and a widened portion ~~(81)~~ connecting the ends of the helical portion, said widened ~~zone~~ ~~(81)~~ portion forming a re-circulation zone for the balls ~~(22)~~ arranged between the ball-race ~~(41-51; 52-62)~~ and the inner surface ~~(21)~~ of ~~this~~ the tubular body ~~(20)~~, ~~this actuator also including and~~

a driving means ~~(2)~~ for rotating the nut ~~(70)~~, in order to ensure ~~the~~ displacement in translation of the tubular body ~~(20)~~ with respect to the ~~latter, characterized in that~~ nut, wherein the inner face ~~(21)~~ of the first tubular body ~~(20)~~ ~~includes~~ comprises helical ball-races for guiding the balls ~~(22)~~.

2. (Currently amended) Actuator according to claim 1, ~~characterized in that~~ wherein the inner surface ~~(21)~~ of the first tubular body ~~(20)~~ has a helical pitch substantially equal to the helical pitch of a ball-race ~~(41-51; 52-62)~~ of the nut ~~(70)~~.

3. (Currently amended) Actuator according to ~~any of the preceding claims, characterized in that the~~ Claim 1, wherein said nut (70) includes comprises several ball-races ~~(41-51; 52-62)~~, each ~~of the~~ ball-races having a re-circulation zone for the balls and in that the ball-races are so arranged that the re-circulation zones for the balls are not aligned in a direction of translation of the actuator.

4. (Currently amended) Actuator according to claim 3, ~~characterized in that~~ wherein the ball-races ~~(41-52; 52-62)~~ are so arranged that the re-circulation zones are regularly angularly distributed about the direction of translation of the actuator.

5. (Currently amended) Actuator according to ~~any of claims 1 to 4, characterized in that the~~ Claim 1, wherein said nut (70) includes comprises several aligned elements ~~(40, 50, 60)~~, of a cylindrical general shape, each element having at least one bevel ~~(41, 51; 52, 62)~~ forming a helical cam surface, the bevels ~~(41, 51; 52, 62)~~ forming, two by two, helical ball-races in which balls ~~(22)~~ are positioned.

6. (Currently amended) Actuator according to claim 5, ~~characterized in that~~ wherein each helical cam surface ~~(41, 51, 52, 62)~~ forms a setback ~~(45, 55)~~, and ~~in that~~ wherein two elements ~~(40, 50, 60)~~ are so positioned with respect to each other that their setbacks ~~(45, 55)~~ are facing each other, said setbacks forming the re-circulation zone ~~(81)~~ for the balls ~~(22)~~.

7. (Currently amended) Actuator according to claim 5, ~~characterized in that the~~ wherein prestressing exerted on the balls ~~(22)~~ is generated by tightening the elements ~~(40, 50, 60)~~ with respect to each other.

8. (Currently amended) Actuator according to claim 7, ~~characterized in that it includes a~~ further comprising: another nut for adjusting ~~(4)~~ the elements ~~(40, 50, 60)~~, in order to control the prestressing exerted on the balls ~~(22)~~.

9. (Currently amended) Actuator according to claim 8, ~~characterized in that it includes further~~ comprising: a springy means (5) interposed between the adjusting nut (4) and the elements (40, 50, 60) of the nut (70), through which the adjusting nut (4) exerts a prestressing on the elements (40, 50, 60).

10. (Currently amended) Actuator according to ~~one of claims 3 to 9, characterized in that~~ Claim 3, wherein each element ~~(40, 50, 60) is formed from~~ comprised of a cylindrical part with a straight cross-section ~~(400), one circular edge of which is~~ thereof being beveled, ~~in order to form and~~ forming said helical cam surface inclined with respect to the axis ~~(401) of the cylindrical part (400),~~ the ends of the helical surface being connected by a setback surface (45) of a conical general shape.

11. (Currently amended) Actuator according to claim 10, ~~characterized in that~~ wherein the ball-race ~~(41-51; 52-62) includes~~ is comprised of a widened re-circulation zone (81) for the balls (22) defined by the setback surfaces of two elements ~~(40, 50), the setback surfaces being positioned in~~ front of each other, in an opposite way.

12. (Currently amended) Actuator according to ~~any of the preceding claims, characterized~~ in that the Claim 1, wherein said driving means (2) ~~for driving the nut (79) include~~ comprises a motor mounted fixed inside a second tubular body ~~(10) capable of,~~ being ~~driven~~ drivable in translation with respect to the first tubular body ~~(20).~~

13. (Currently amended) Actuator according to ~~one of claims 1 to 12, characterized in that~~ Claim 1, wherein the ball-races at the level of the inner surface ~~(21) of the tubular body (20) are~~ formed by comprised of plastic distortion of ~~this~~ the inner surface ~~(21) by the balls (22), followed~~ by a treatment for hardening this inner surface ~~(21) of the tubular body (20).~~

14. (Currently amended) Actuator according to ~~any of claims 1 to 12~~, characterized in that Claim 1, wherein the ball-races at the level of the inner surface-(21) of the first tubular body-(20) are ~~formed by~~ comprised of at least one wire-(91) positioned in the shape of a spiral inside the first tubular body-(20).

15. (Currently amended) Actuator according to claim 14, ~~characterized in that it includes~~ further comprising: a first wire (91) positioned in the shape of a spiral inside the first tubular body (20), on which the balls-(22) rest, and a second intercalated wire-(92) having a diameter smaller than that of the first wire (91) and extending between the windings of the first wire-(91), ~~this said~~ second wire (92) maintaining the separation between the windings of the first wire-(91).

16. (Currently amended) Actuator according to ~~one of claims 1 to 12~~, characterized in that ~~it includes~~ Claim 1, further comprising: an inner tube (93) arranged in the tubular body-(20) and welded to the ~~latter~~ tubular body, the inner tube-(93) having ball-races carried out by burnishing.

17. (Currently amended) Actuator according to ~~one of the preceding claims~~, characterized ~~in that it has~~ Claim 1, further comprising: a third tubular body-(300), the first tubular body-(20) being connected to a second nut-(370), ~~the~~ rotation of the second nut (370) causing the displacement in translation of the third body with respect to the first tubular body-(20), the actuator thus constituting an actuator of the telescopic type.

18. (Currently amended) Actuator according to ~~one of the preceding claims~~, characterized ~~in that~~ Claim 1, wherein the first tubular body-(20) is ~~made out~~ comprised of aluminum, KEVLAR®, carbon fibers or molded plastic.